

## DIPTEROUS PARASITES OF SPIDER EGG SACS.

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So far as is known, dipterous "parasites" of spider egg sacs are actually egg predators, the maggots not completing their development within a single egg but lying free in the sac among the eggs. The first recorded case was that of a *Tachina* sp. reared by Bertkau (1880) from *Epeira cornuta*. König (1894) reported that C. Koch had reared *Ogcodes sanguinea* Latr. and *O. trigramma* Loew from the egg sacs of *Tegenaria*, but all other rearings of Cyrtidae have been as parasites from within the bodies of the spiders themselves (Kaston, 1937).

Among the Phoridae, *Megaselida epeirae* (Brues) was reared by Brues (1902, 1903) from *Epeira* sp. The same species was obtained by Auten (1925) from *Epeira scolopetaria*. Through the courtesy of Mr. P. A. Berry, of the New Haven laboratory of the U. S. D. A. Bureau of Entomology and Plant Quarantine, we were enabled to examine an egg sac of *Argiope aurantia* parasitized by *Megaselida* sp. This sac was collected by T. Duffy at Westport, Conn., on May 7, 1937. Starting May 14, there emerged from this sac seven specimens of *Megaselida* (as well as four of *Pseudogaurax anchora*, see below), and a few spiderlings. When examined on May 17, no larvae of *Megaselida* remained, but one puparium was found, from which the imago emerged May 18. The puparium (figs. 9, 10) is reddish brown, 3.2 mm. long, 1.3 mm. at its widest part, and 1.2 mm. high. There is a distinct lateral ridge, and a pair of long thin processes arising on the dorsal surface. There are 6 tubercles on the ventral surface of the last segment, and a pair of smaller tubercles is present on each segment near the lateral border of the dorsum. When the imago emerges, the puparium splits as shown in figure 11.

Among the Sarcophagidae, *Sarcophaga davidsoni* Coq. was recorded by Coquillett (1892) and Davidson (1894) from *Phidippus opifex* McCook. In the intensive study made by Auten, specimens of *S. hinei* Aldrich were reared from *Philodromus canadensis* Emerton, *Epeira scolopetaria* and *Aranea frondosa* (= *Epeira cornuta*). On July 2, 1935 at West Haven, Conn., a female of the latter species was collected in alcohol together with the two egg sacs over which it was standing guard. Sometime later when the sacs were opened for the purpose of counting the eggs, it was discovered that one of them contained a few ready-to-emerge spider-

lings, a few shriveled eggs, and four larvae of *Sarcophaga* sp. (*hinei?*), which had eaten all the remaining eggs. The larvae (fig. 1) were all of about the same size and stage of development, 7.5 mm. long, 3 mm. maximum width and 2.4 mm. at the greatest thickness.

From a comparison with the description given by Knipling (1937) for *S. cistudinis* it would appear that they were in the third, or last, instar. There is a rather deep posterior cavity in which lie the two spiracular plates (fig. 4). Each is bordered by a ventrally incomplete peritreme, and has three slits. Each of the prothoracic spiracles has 22 small lobes or branches. At the anterior end of the head there is a pair of tubercles on each side. The cephalopharyngeal skeleton (fig. 3) is shorter and higher than that figured by Knipling. The oral hooks are toothed, and the lateral cornua are not connected posteriorly with the dorsal.

It is from among the Chloropidae that we have the most numerous records of parasitism. *Pseudogaurax signata* (Loew),<sup>1</sup> first reared by Davidson (1896) from *Epeira angulata* and *Latrodectus mactans*, and later by Coquillett (1898) from *Argiope aurantia*,<sup>2</sup> were again obtained from *L. mactans* in considerable numbers by Jenks (1936). Herms *et al.* (1935) report a Chloropid from *L. mactans* which is presumably *P. signata*. The life history of this species has been given by Jenks in several popular magazines, and recently by Kessel and Kessel (1937). *P. lancifer* (Coq.) was bred from an undetermined egg sac by Coquillett (1900). Auten reared *P. anchora* (Loew) from *Epeira cornuta*, and *Oscinis halterata* Mall. from the latter species, *E. sclopetaria* and *Philodromus canadensis*. *Siphonella oscinina* (Fall.) was reported by Coquillett (1898) from an undetermined sac, and Kintner (1935) reared a *Siphonella* sp. from *Tetragnatha* sp.

From an egg sac of *Argiope aurantia* collected at Westport, Conn. (referred to above in connection with *Megaselida*) were obtained four specimens of *Pseudogaurax anchora* (Loew). The puparia closely resemble those of *P. signata* described below, so that it is practically impossible to distinguish between them. The adults emerged between May 14 and May 21. They can be easily

<sup>1</sup> More widely known under the name of *Gaurax araneae* Coq. That this is a synonym of *signata* Loew was suggested by Becker in his 1912 Monograph on the Chloropidae. Hall (*in litt.*) confirms this synonymy.

<sup>2</sup> Mr. C. S. Brimley writes that he reared *P. signata* from this species at Raleigh, N. C., Apr. 13-17, 1928.

distinguished from those of *signata* by the color pattern on the mesonotum and scutellum (figs. 12 and 13).

A large number of specimens of *Pseudogaurax signata* were reared by us in the laboratory, from the sacs of *L. mactans*. The original material was taken at Los Angeles, Calif. Though the usual life of adults is about two months, under conditions of a more or less constant temperature of about 23° C. and a relative humidity of about 65%, some lived over three. A constant supply of water and a cube of sugar were kept in the cage with them and occasionally a little honey and yeast mixture was given.

During the second to fifth week after emergence, the females lay from 40 to 45 eggs on the surface of the host sac. The first batch usually contains 16 to 18, with decreasing numbers thereafter. The eggs average .574 by .154 mm. They are glistening white, longitudinally ridged, and as shown in figure 5, more tapering at one end, the micropylar area. The period of incubation is 5 or 6 days. The newly hatched larva (fig. 6) is .64 mm. long, bears a pair of two-segmented short antennae, and a pair of postero-dorsal raised spiracles. Entrance into the egg-sac of the host is effected by pushing aside and crawling between the loose fibers. At times if the sac is too compactly built the larvae are unable to push through and wander about, only to die in a day or so. In contrast with the metapneustic young larva, the last instar larva is amphipneustic, a pair of 5-lobed prothoracic spiracles being present. It is also much thicker at the posterior end as seen in figure 18. These larvae are about 3.5 mm. long and shorten to about 3 mm. when changing to pupae (fig. 8). The length of larval life is 8 or 9 days, of pupal life 11 or 12. Figures 14-21 illustrate various stages in the life cycle.

An attempt was made to induce the fly to oviposit on egg sacs of a number of other species of spiders. However, although this was successful with *Theridion tepidariorum* (ten eggs were laid, of which three flies matured), a marked preference is exhibited for the sacs of *L. mactans*. In fact, this fly may well be a means of biological control of the black widow in those areas where the latter has become uncomfortably abundant in recent years. Very little equipment is needed for laboratories in the southern and western states to rear these flies in large quantities.

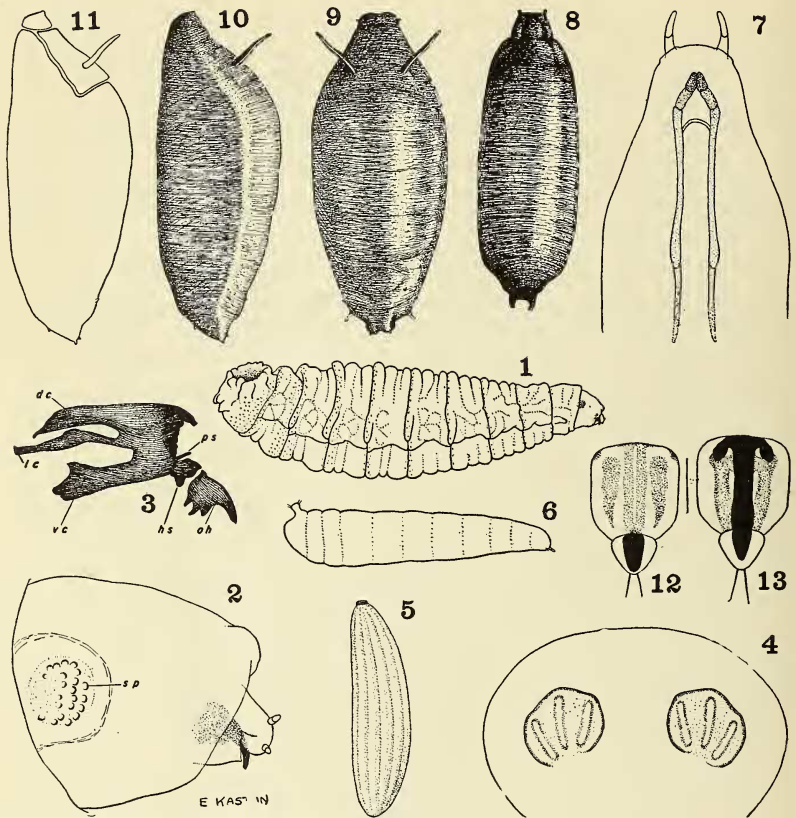
We are indebted to Messrs. C. W. Sabrosky, D. G. Hall, and C. H. Curran for aid of a taxonomic nature.

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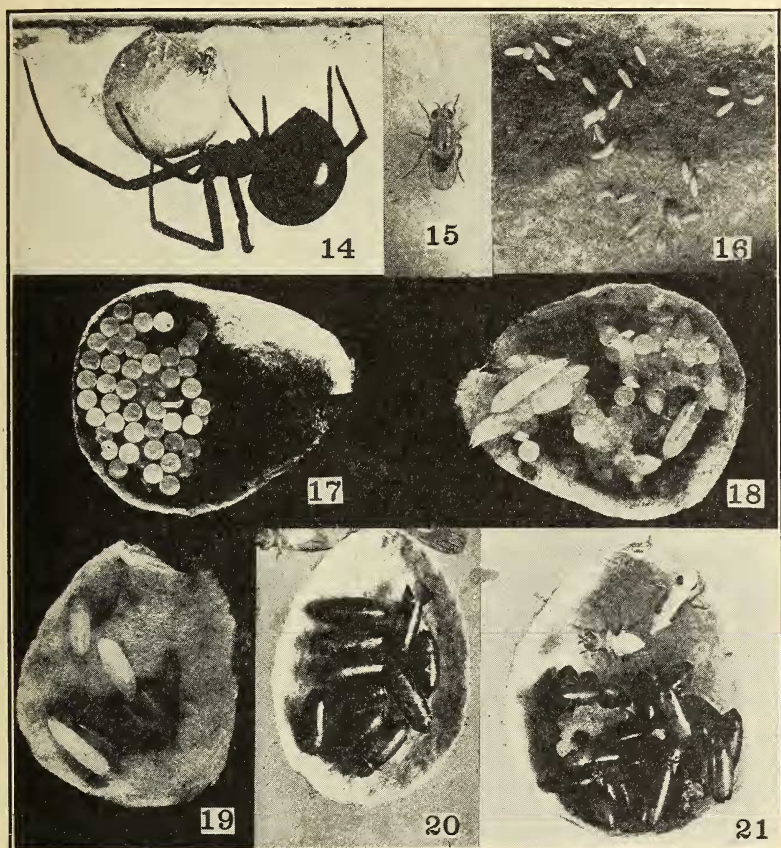
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## EXPLANATION OF PLATE III.

1. *Sarcophaga* sp. larva from egg sac of *Epeira cornuta*. Lateral aspect.



2. Same, prothorax and head; *sp*, spiracle.
3. Same, cephalopharyngeal skeleton; *oh*, oral hooks; *hs*, hypostomal sclerite; *ps*, parastomal sclerite; *dc*, dorsal cornu; *lc*, lateral cornu; *vc*, ventral cornu.
4. Same, posterior spiracular plates.
5. *Pseudogaurax signata*, egg.
6. Same, first instar larva, lateral aspect.
7. Same, dorsal aspect of anterior end showing antennae and cephalopharyngeal skeleton.
8. Same, puparium, dorsal aspect.
9. Puparium of *Megaselida* sp. Dorsal aspect.
10. Lateral aspect of same.
11. Same, showing where splitting occurred in emerging.
12. Mesonotum and scutellum of adult *P. signata*.
13. Mesonotum and scutellum of adult *P. anchora*.



## EXPLANATION OF PLATE IV.

(All photographs by G. E. Jenks)

14. *Latrodectus mactans* with its egg sac on which can be seen a specimen of *Pseudogaurax signata* and eggs of the latter.
15. Adult *P. signata* more highly enlarged.
16. Eggs and newly hatched larvae still more highly enlarged.
17. Inside of the spider's egg sac showing a young larva among the host eggs.
18. Full grown larvae.
19. Young pupae.
20. Old pupae. Note opened puparium from which imago has emerged.
21. Note young imago with wings not yet spread, and everted ptilinum extending anterior to the eyes.